DATA SHEET

GRF5847

PRELIMINARY DATA SHEET

35 dBm Linear PA Module 4.4 to 5.2 GHz

FEATURES

- No External Matching
- Flexible Bias and Voltage Control
- Digital Shutdown
- Process: InGaP HBT

Reference: 5 V / 260 mA / 4.7 GHz

- Gain: 40 dB
- P_{SAT}: 35.5 dBm
- Collector Efficiency: 52%
- Excellent EVM/ACLR vs. P_{OUT}

APPLICATIONS

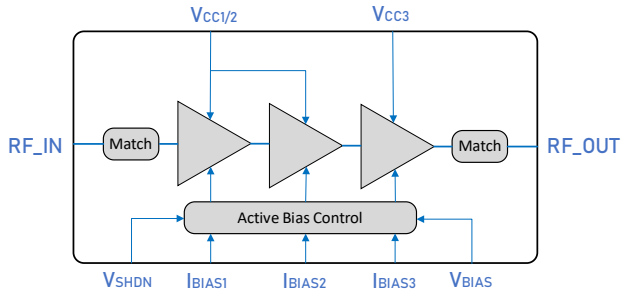
- C-Band Linear PA
- Point to Point Data Links
- Air Ground Air Operations
- Ship Shore Ship Operations
- N79 Wireless Infrastructure

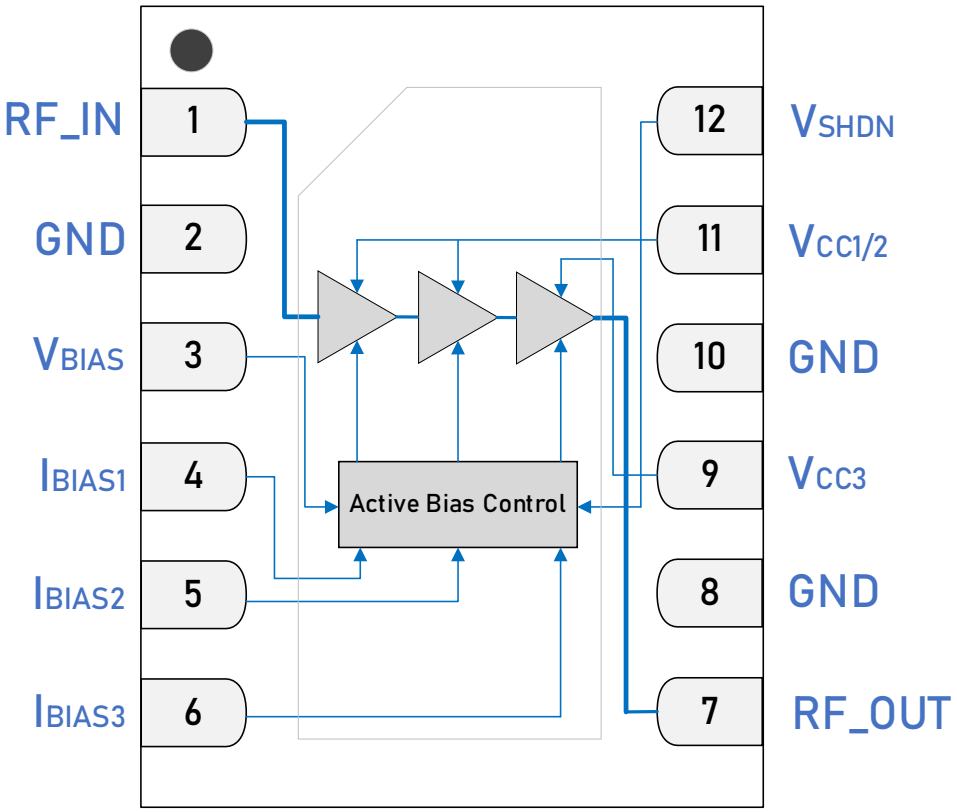
DESCRIPTION

The GRF5847 is a PA module achieving 35+ dBm saturated output power from 4.4 to 5.2 GHz with power added efficiency greater than 50%. Due to its high native linearity, the device does not require digital predistortion. It can be operated over a range of supply voltage levels from 3 to 5 volts requiring no external matching.

Please consult with the GRF applications engineering team for custom tuning/evaluation board data.

BLOCK DIAGRAM





2.5 x 3.0 mm LAMM-12 Pin Out (Top View)

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Pin Assignments

Pin	Name	Description	Note
1	RF_IN	RF Input	Internally matched to 50 Ω. Connected to internal ESD protection circuit. Do not apply external DC voltage.
2, 8, 10	GND	Ground	Provides RF and DC ground for PA.
3	V_{BIAS}	Bias Circuit Supply	Connect to V_{CC} voltage.
4	I_{BIAS1}	1st Stage Bias Reference Current	Connect to V_{CC} through an external resistor.
5	I_{BIAS2}	2nd Stage Bias Reference Current	Connect to V_{CC} through an external resistor.
6	I_{BIAS3}	3rd Stage Bias Reference Current	Connect to V_{CC} through an external resistor.
7	RF_OUT	RF Output	Internally matched to 50 Ω. Internally DC blocked.
9	V_{CC3}	3rd Stage Collector Voltage	Connect to V_{CC} voltage.
11	$V_{CC1/2}$	Collector Voltage for Stage 1 and 2	Connect to V_{CC} voltage.
12	V_{SHDN}	Digital Shutdown Pin	$V_{SHDN} \geq 2$ volts (Logic HIGH) disables device. $V_{SHDN} \leq 0.8$ volts (Logic LOW) enables device.
PKG BASE	GND	Ground	Provides DC and RF ground for the PA as well as thermal heat sink. Recommend multiple 8 mil vias beneath the package for optimal RF and thermal performance. Refer to evaluation board top layer graphic on schematic page.

Absolute Ratings

Parameter	Symbol	Min.	Max.	Unit
Supply Voltage	V_{CC}	0	5.5	V
Transient Average RF Input Power: Load VSWR < 2:1, V_{CC} = 5 V. Duration: < 1 hour.	$P_{IN\ MAX}$		TBD	dBm
Operating Temperature (Package Base)	$T_{PGK\ BASE}$	-40	85	°C
Maximum Channel Temperature (MTTF: TBD)	T_{MAX}		170	°C
Maximum Dissipated Power	$P_{DISS\ MAX}$		TBD	W

Electrostatic Discharge

Charged Device Model	CDM	TBD		V
Human Body Model	HBM	TBD		V

Storage

Storage Temperature	T_{STG}	-65	150	°C
Moisture Sensitivity Level	MSL		TBD	--

Caution! ESD Sensitive Device.
Exceeding Absolute Maximum Rating conditions may cause permanent damage.

Note: For additional information, please refer to *Manufacturing Note MN-001 — Package and Manufacturing Information.*

All Guerrilla RF products are provided in RoHS compliant lead (Pb)-free packaging requiring no exemptions. Additional information for this topic can be found at this link - *Environmental and Restricted Substance Statement Library*

Recommended Operating Conditions

Parameter	Symbol	Specification			Unit	Condition
		Min.	Typ.	Max.		
Supply Voltage	V_{CC}	2.7	5	5.5	V	
Operating Temperature (Package Base)	$T_{PKG\ BASE}$	-40		85	°C	
RF Frequency Range	F_{RF}	4.4		5.2	GHz	Typical application schematic.
RF_IN Port Impedance	Z_{RFIN}		50		Ω	Single-ended.
RF_OUT Port Impedance	Z_{RFOUT}		50		Ω	Single-ended.

Nominal Operating Parameters – General

The following conditions apply unless noted otherwise: typical application schematic using the 4.4 to 5.2 GHz tuning set, V_{CC} = 5 V, I_{CC} = 260 mA, F_{TEST} = 4.7 GHz, 50 Ω impedance, $T_{PKG\ BASE}$ = 25 °C. Evaluation board losses are included within the specifications.

Parameter	Symbol	Specification			Unit	Condition
		Min.	Typ.	Max.		
Quiescent Current	I_{CCQ}		260		mA	
Bias Current ($V_{CC1/2}$)	$I_{BIAS\ Vcc1/2}$		55		mA	
Bias Current (V_{CC3})	$I_{BIAS\ Vcc3}$		215		mA	
Enable Current	I_{ENABLE}		11		mA	
Switching Rise Time	T_{RISE}		TBD		ns	Disabled mode to Gain mode **(note 3)**.
Switching Fall Time	T_{FALL}		TBD		ns	Gain mode to Disabled mode **(note 4)**.

Disabled Mode

Enable Current	I_{ENABLE}		750		µA	V_{CC} = 5 V, V_{SHDN} = 5 V, V_{BIAS} = 5 V.
Bias Current	I_{BIAS}		17		mA	V_{CC} = 5 V, V_{SHDN} = 5 V, V_{BIAS} = 5 V.

Thermal Data

Thermal Resistance: (Infrared Scan)	Θ_{JC}		TBD		°C/W	On standard evaluation board **(note 5)**.

Note 3: Switching Time: 50% of V_{SHDN} to 90% of P_{OUT}.

Note 4: Switching Time: 50% of V_{SHDN} to 10% of P_{OUT}.

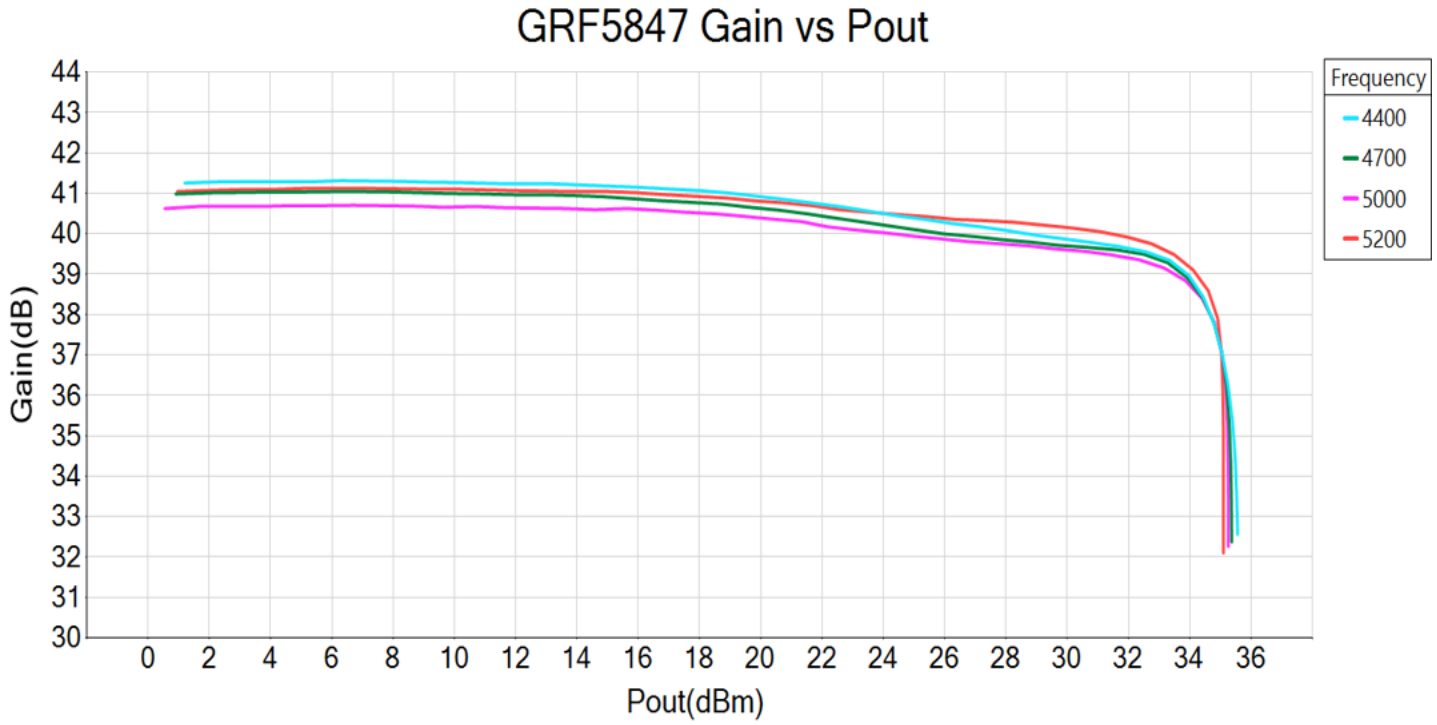
Note 5: MTTF: TBD.

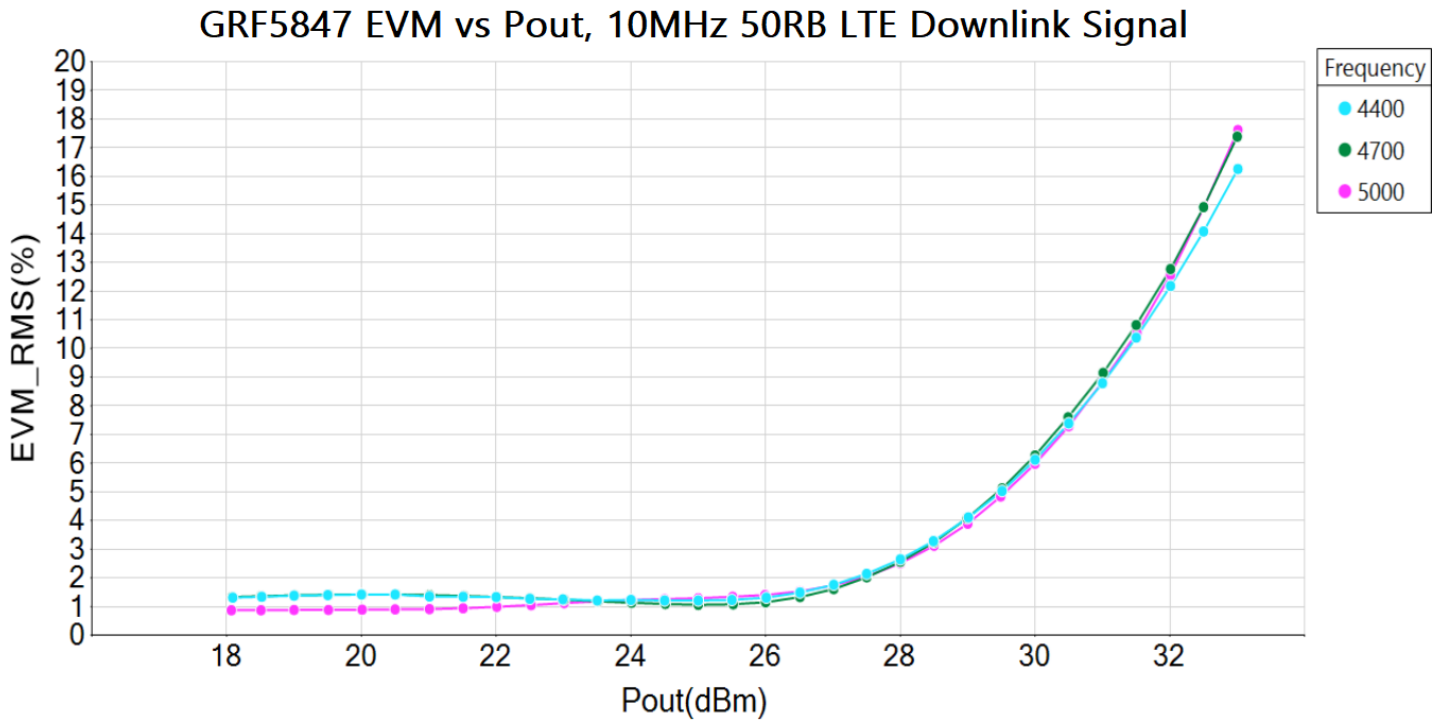
Nominal Operating Parameters – RF

The following conditions apply unless noted otherwise: typical application schematic using the 4.4 to 5.2 GHz tuning set, V_{CC} = 5 V, I_{CC} = 260 mA, F_{TEST} = 4.7 GHz, 50 Ω impedance, $T_{PKG\ BASE}$ = 25 °C. Evaluation board losses are included within the specifications.

Parameter	Symbol	Specification			Unit	Condition
		Min.	Typ.	Max.		
Gain	S21		40		dB	
Saturated Output Power	P_{SAT}		35.5		dBm	
Peak Collector Efficiency	η		52		%	
Noise Figure	NF		4.8		dB	On standard evaluation board.
Output 3rd Order Intercept Point	OIP3		43		dBm	P_{OUT} = 26 dBm per tone at 600 kHz spacing.

GRF5847 Typical Operating Curves: 4.4 to 5.2 GHz Tune





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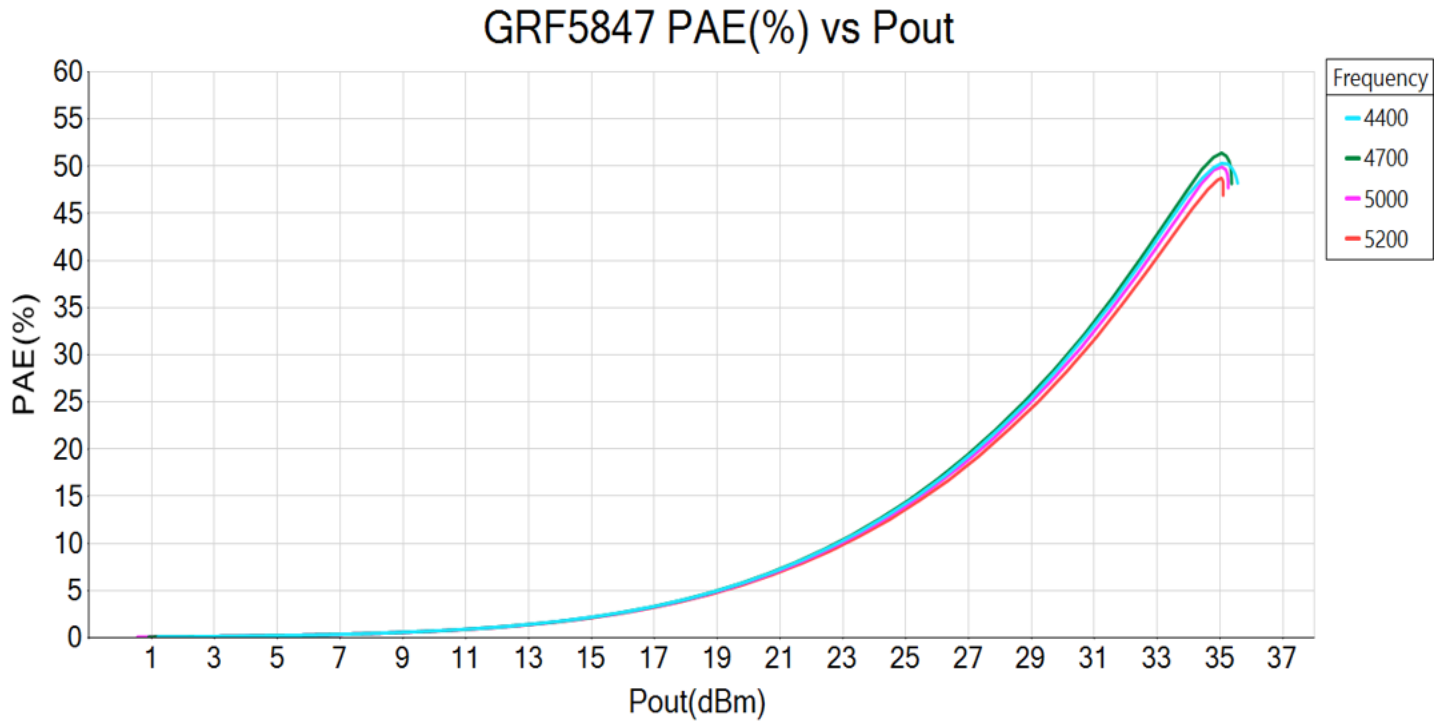
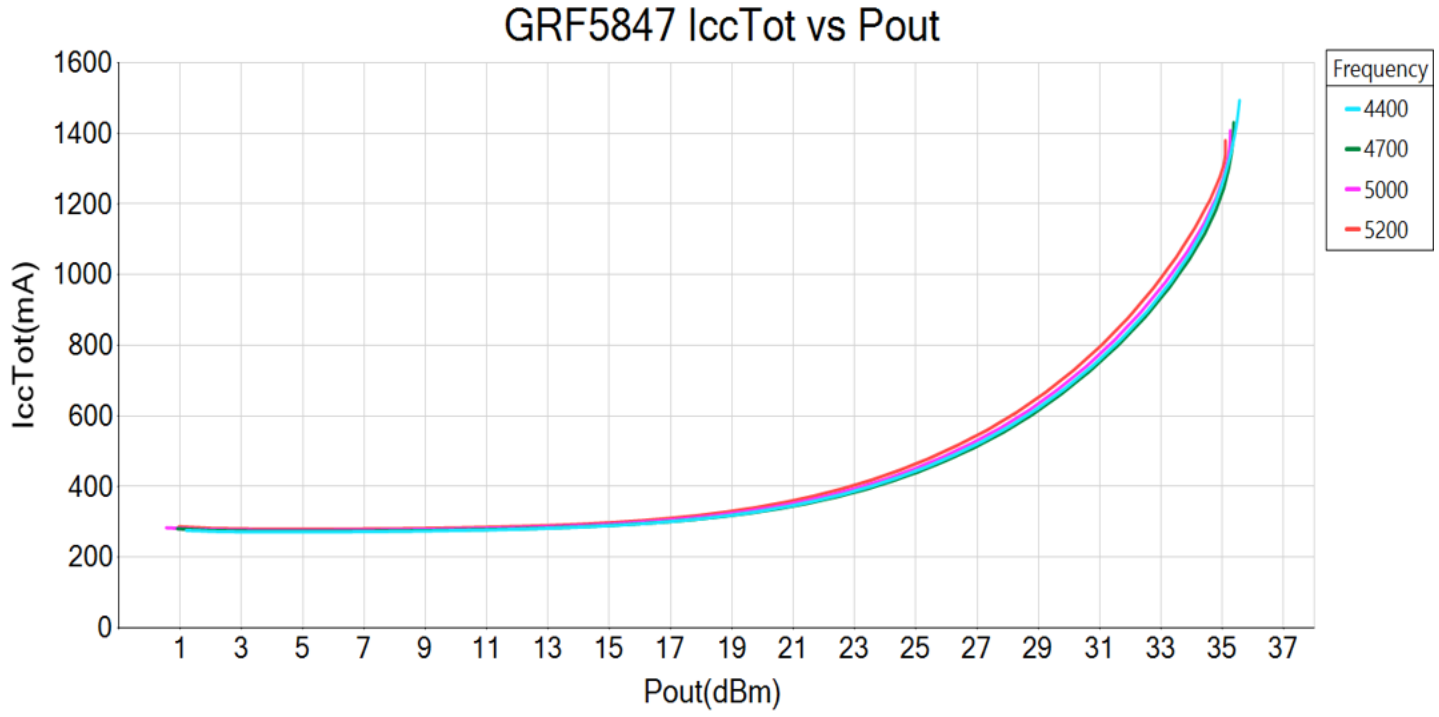
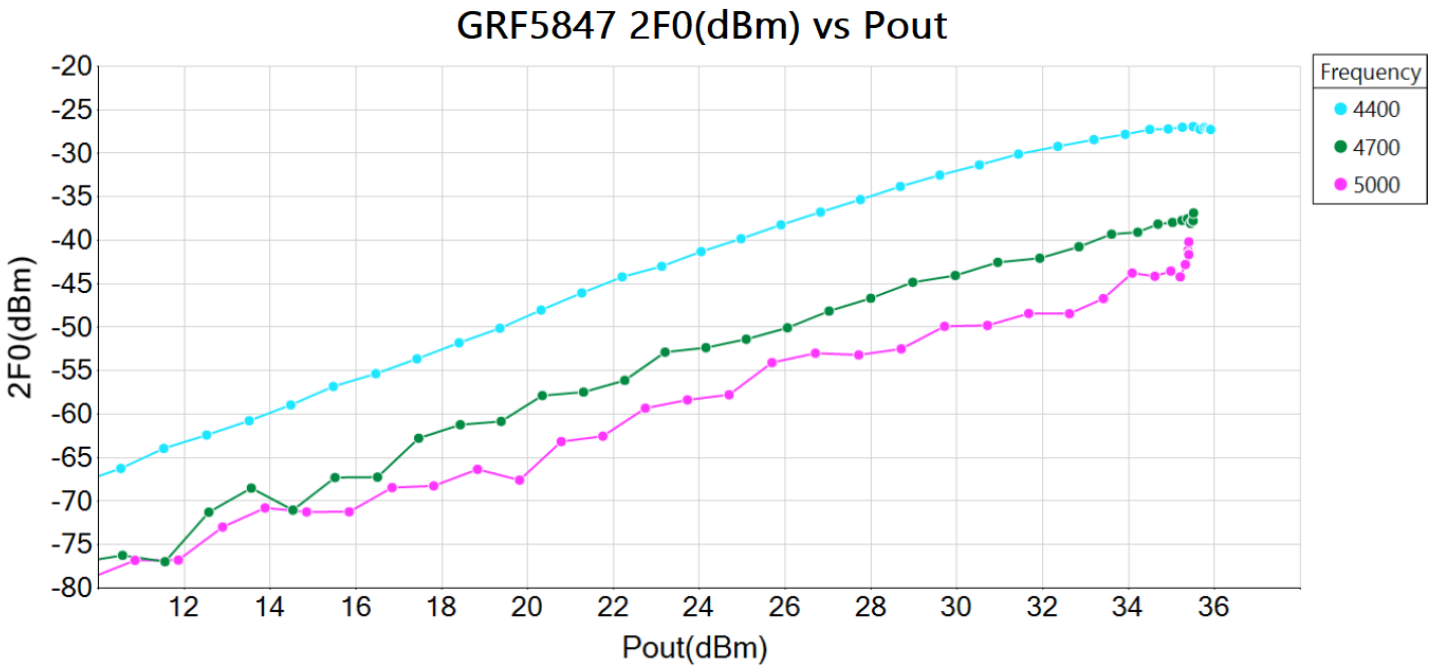
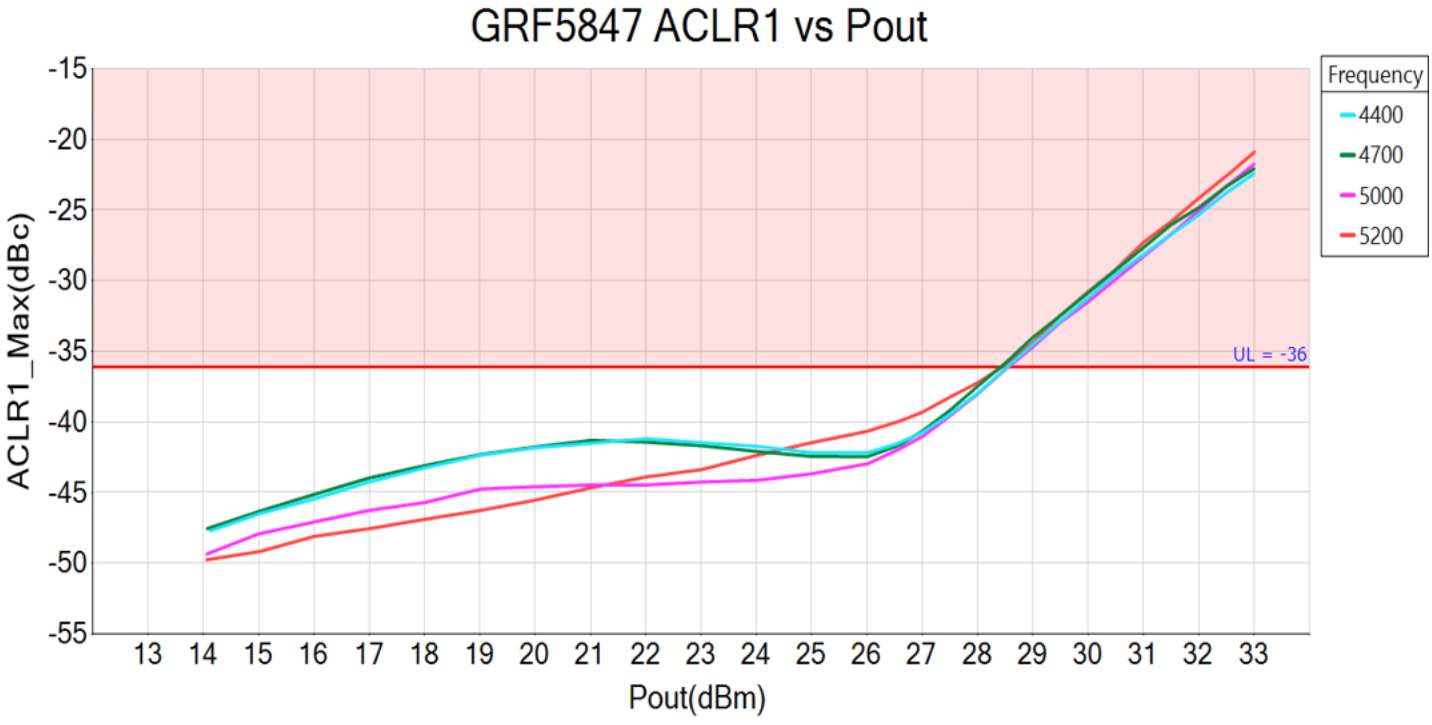
GRF5847 Typical Operating Curves: 4.4 to 5.2 GHz Tune





GRF5847 Typical Operating Curves: 4.4 to 5.2 GHz Tune





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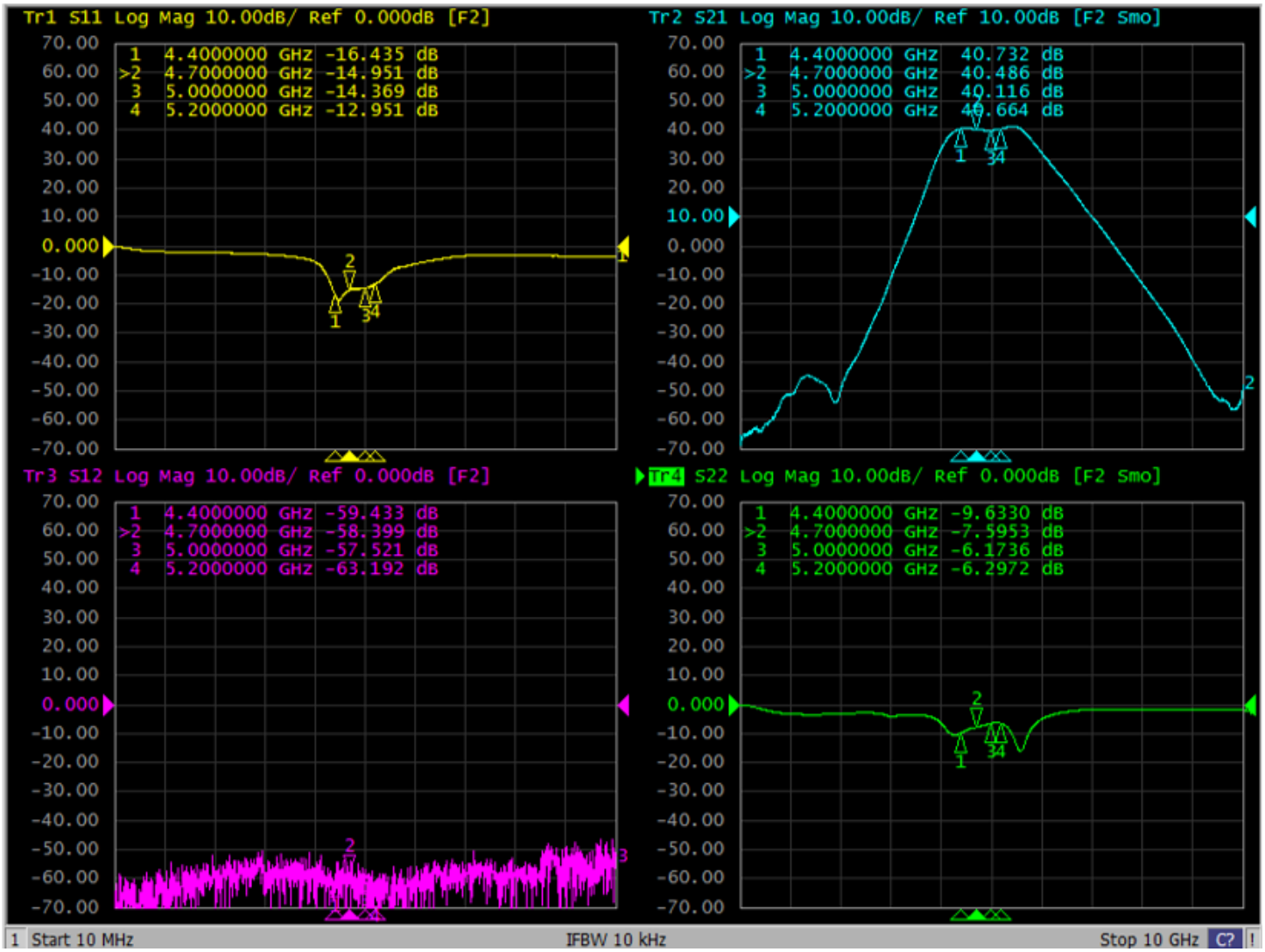
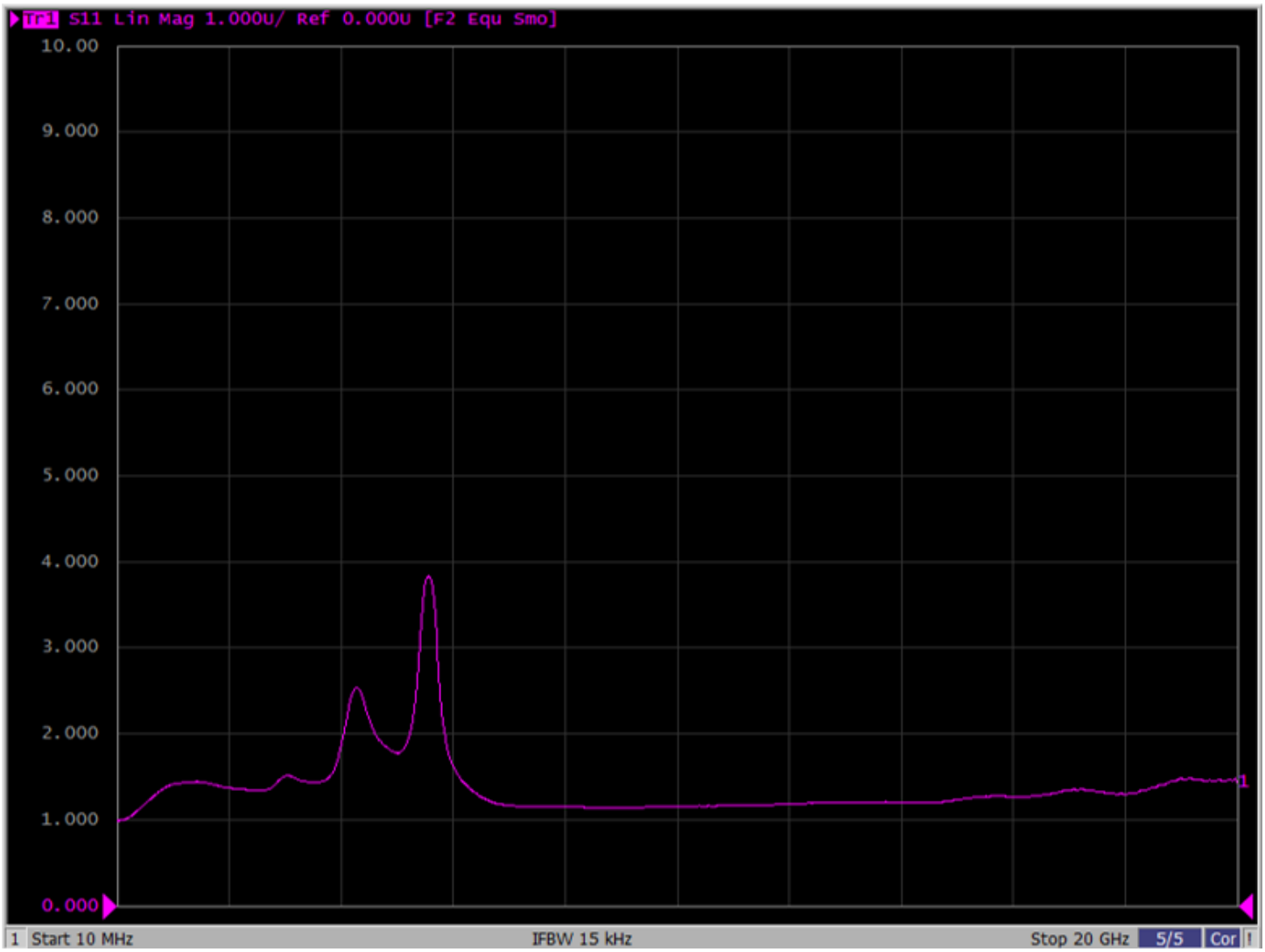
GRF5847 Typical Operating Curves: S-Parameters (4.4 to 5.2 GHz Tune)



GRF5847 Typical Operating Curves: Stability Mu Factor (10 MHz to 20 GHz)



Note: Mu factor ≥ 1.0 implies unconditional stability.

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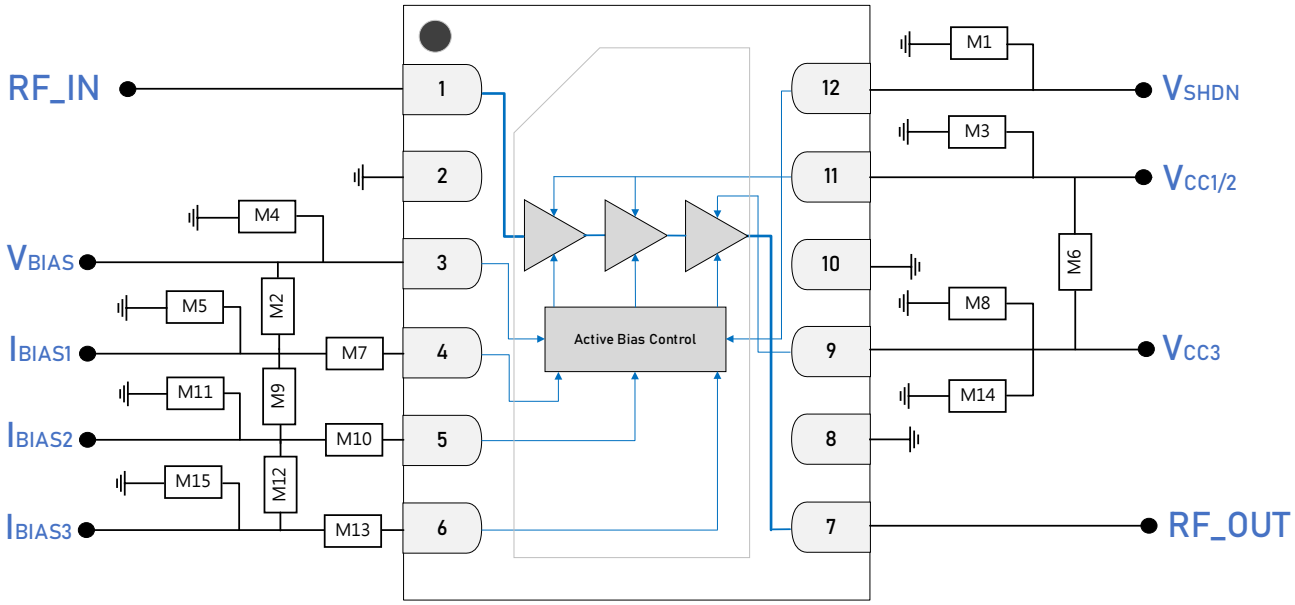
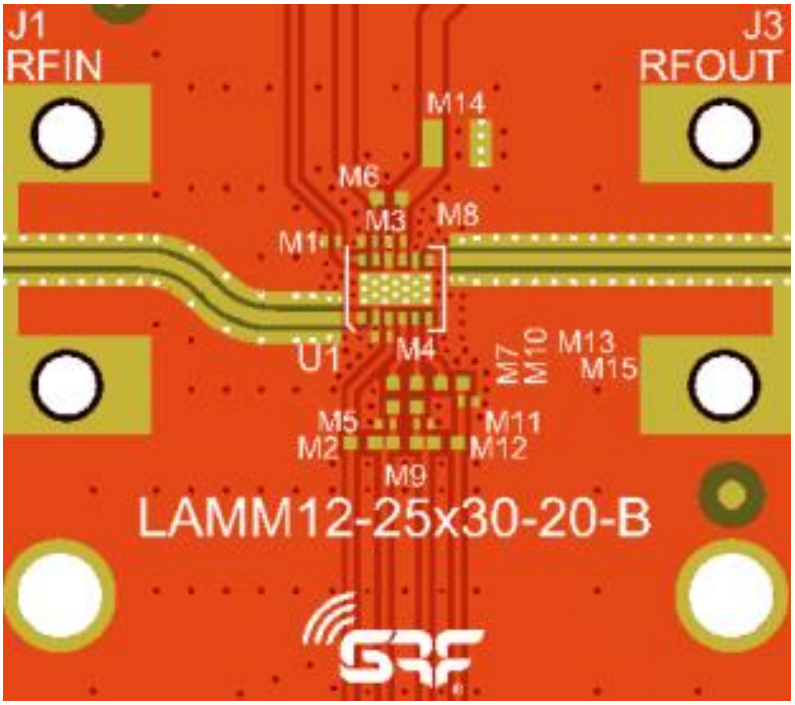


GRF5847 Standard Evaluation Board Schematic



GRF5847 Evaluation Board Assembly Diagram

GRF5847 Evaluation Board Assembly Diagram Reference: 4.4 to 5.2 GHz Tune

Component	Type	Manufacturer	Family	Value	Package Size	Substitution
M1	Capacitor	Murata	GRM	220 pF	0201	ok
M2, M9, M12	Resistor (jumper)	Various	5%	0 Ω	0402	ok
M3, M4, M8	Capacitor	Murata	GRM	0.1 µF	0201	ok
M5, M6, M11, M15	DNP					
M7	Resistor	Various	1%	1.3 kΩ	0402	ok
M10	Resistor	Various	1%	806 Ω	0402	ok
M13	Resistor	Various	1%	590 Ω	0402	ok
M14	Capacitor	Kemet	T529	22 µF	0805	ok
Evaluation Board	LAMM12-25x30-20-B					

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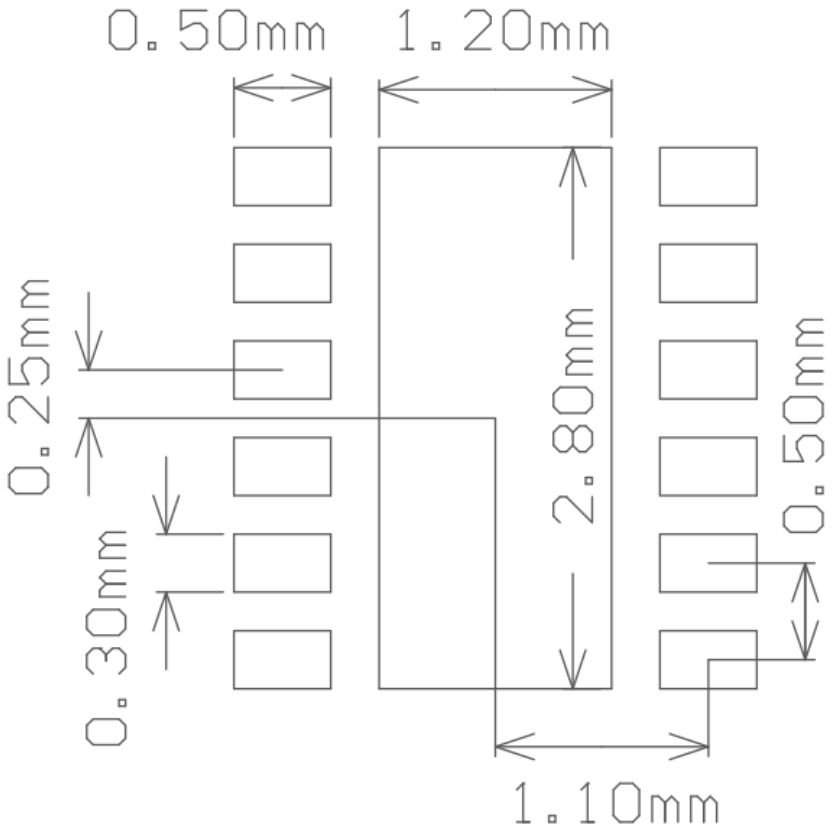
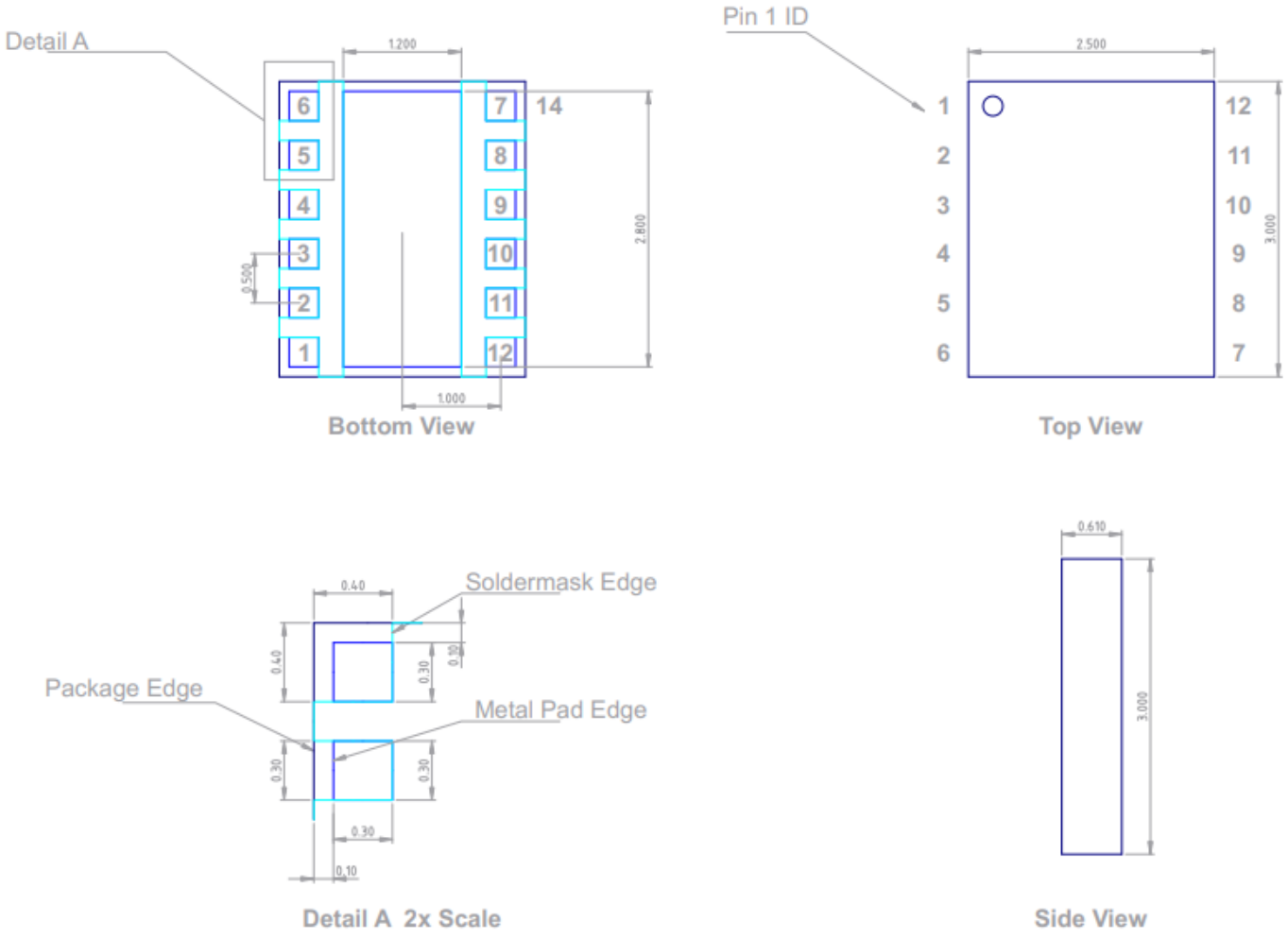


2.5 x 3.0 mm LAMM-12 Suggested PCB Footprint (Top View)



2.5 x 3.0 mm LAMM-12 Package Dimensions

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Package Marking Diagram

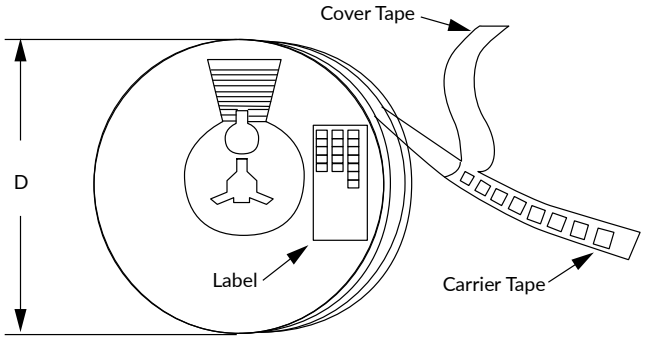
- Line 1: "YY" = YEAR. "WW" = WORK WEEK the device was assembled.
- Line 2: "XXXX" = Device PART NUMBER.

Tape and Reel Information

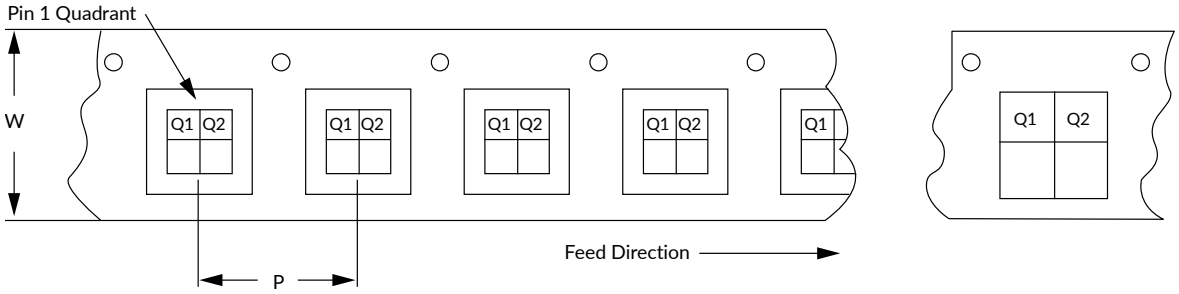
Guerrilla RF's tape and reel specification complies with Electronic Industries Alliance (EIA) standards for "Embossed Carrier Tape of Surface Mount Components for Automatic Handling" (reference EIA-481). See the following page for the Tape and Reel Specification and Device Package Information table, which includes units per reel.

Devices are loaded with pins down into the carrier pocket with protective cover tape and reeled onto a plastic reel. Each reel is packaged in a cardboard box. There are product labels on the reel, the protective ESD bag and the outside surface of the box.

For the Tape and Reel Reference Table, please refer to: Package Manufacturing Information | Guerrilla RF (guerrilla-rf.com)



Tape and Reel Packaging with Reel Diameter Noted (D)



Carrier Tape Width (W), Pitch (P), Feed Direction and Pin 1 Quadrant Information

Revision History

Revision Date	Description of Change
September 5, 2024	Advance Data Sheet.
October 21, 2024	Preliminary Data Sheet.
January 15, 2025	Changed Mean Time to Failure (MTTF) to TBD.

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Data Sheet Classifications

Data Sheet Status	Notes
Advance	S-Parameter and NF data based on EM simulations for the fully packaged device using foundry-supplied transistor S-Parameters. Linearity estimates based on device size, bias condition and experience with related devices.
Preliminary	All data based on limited evaluation board measurements taken within the Guerrilla RF Applications Lab. All parametric values are subject to change pending the collection of additional data.
Release Ø	All data based on measurements taken with *production-released* material. TYP values are based on a combination of ATE and bench-level measurements, with MIN/MAX limits defined using *modelled estimates* that account for part-to-part variations and expected process spreads. Although unlikely, future refinements to the TYP/MIN/MAX values may be in order as multiple lots are processed through the factory.
Release A-Z	All data based on measurements taken with production-released material *derived from multiple lots which have been fabricated over an extended period of time*. MIN/MAX limits may be refined over previous releases as more statistically significant data is collected to account for process spreads.